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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/701,499	11/06/2003	Takeshi Tachibana	KOBE.0057	7640

7590 05/24/2005

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EXAMINER	
RAO, SHRINIVAS H	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 05/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/701,499	TACHIBANA ET AL.	
	Examiner	Art Unit	
	Steven H. Rao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 March 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-20* is/are pending in the application.

4a) Of the above claim(s) *7-20* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1 and 3-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12/15/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Response to Amendment

Applicants' amendment filed on February 16, 2005 has been entered on March 09, 2005 .

Therefore claims 1 and 5 as amended by the amendment and claims 3-4 and 6 as previously recited are currently pending in the Application.

Claim 2 has been cancelled by the amendment.

Claims 7 to 20 were previously withdrawn and must be cancelled as set out below.

Election/Restrictions

This application contains claims 7 to 20 drawn to an invention nonelected with traverse in Paper received on March 09, 2005 .

A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3 to 5 are rejected under 35 U.S.C. 103 as being obvious over Ohya et al. (U.S. Patent No. 5,686,172 herein after Ohya) newly applied and further in view of

Clevenger et al. (U.S. Patent No. 6,337,513, herein after Clevenger previously applied).

With respect to claim 1 Ohya describes a semiconductor device having a heat spreader comprising a diamond-containing material (Ohya).
Ohya does not specifically mention that the diamond containing material has a thermal conductivity of 350 W/(m K) or more.

However Clevenger , a patent from the same filed of endeavor describes in table 1 etc. a thermal conductivity of 350 W/(m K) or more is an inherent property of diamond , which has a thermal conductivity about 1000-2000 K for diamond and 100-150 K for silicon , eg. see Clevenger table 1, to facilitate heat removability by forming a highly heat conductive path to the heat sink.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Clevenger's disclosure of materials having thermal conductivity of 350 W/(m K) or more in Ohya's semiconductor device to facilitate heat removability by forming a highly heat conductive path to the heat sink.

The reaming limitations of claim1 are :

The heat spreader being directly disposed entirely or partially on the reverse surface of the semiconductor device. (Clevenger fig. 1 #14 on reverse surface of 10, and same as specification figure IA, spec. page 9 last six lines also figures 6 E-F, col. 6 lines 15-25). wherein the diamond-containing material is a composite of a diamond layer and a ceramic layer or a mixture of diamond particles and ceramic articles, the

ceramic layer or the ceramic particles (Ohya col. 5 lines 3-20 and Clevengér col. 3 line 19) comprising at least one of silicon carbide and aluminum nitride. (Ohya col.9 lines 10-15 – Aluminum nitride, Clevenger col. 3 lines 18-25, silicon carbide) .

With respect to claim 3 Ohya describes the semiconductor device according to Claim 1 , wherein the heat spreader is directly disposed on a substrate for the semiconductor device. (Clevenger fig. 1 , col. 4 lines 1-5).

With respect to claim 4 Ohya describes the semiconductor device according to Claim 1, wherein the heat spreader has an irregular surface facing away from the semiconductor device. (Clevenger figures 6c-d # 62)

With respect to claim 5 Ohya and Clevenger describe a semiconductor package accommodating the semiconductor device 1 having a heat spreader comprising the heat spreader being directlv disposed entirelv or padially on the reverse surface of the semiconductor device, (Clevenger fig. I #14 on reverse surface of 10) wherein a metal heat sink or a metal radiating fin is bonded on a surface of the heat spreader facing away from the semiconductor device. (Clevenger figure 4 # 44) wherein the diamond-containing material is a composite of a diamond layer and a ceramic layer or a mixture of diamond particles and ceramic articles, the ceramic layer or the ceramic particles (Ohya –abstract, col.5 etc ,Clevenger col. 3 line 19) comprising at least one of silicon carbide and aluminum nitride. (Ohya col.9 lines 10-15 – Aluminum nitride, Clevenger col. 3 lines 18-25, silicon carbide) .

Claim Rejections - 35 USC Section 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negatived by the manner in which the invention was made. .

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohya et al. (U.S. Patent No. 5,686,172 herein after Ohya) Clevenger (U.S Patent No. 6,337,513, herein after Clevenger) as applied to claims 1-5 above and further in view of Anschel (U.S. Patent No. 4,914,551 , herein after Anschel).

With respect to claim 6, Ohya and Clevenger describes the semiconductor package according to Claim 5.

Ohya and Clevenger does not specifically describe a polymer adhesive layer is used to bond the metal heat sink or the metal radiating fin on the surface of the heat spreader.

However , Anschel a patent from the same filed of endeavor describes in col. 4 lines 45-55 a polymer adhesive layer is used to bond the metal heat sink or the metal radiating fin on the surface of the heat spreader to provide an electrically insulative and

highly thermally conductive adhesive diamond or a diamond-containing material having a thermal conductivity of 350 W/(mK) or more. (Clevenger fig.I #14, col. 3 lines 65-67).

Response to Arguments

Applicant's arguments filed on March 09, 2005 have been fully considered but they are not persuasive for the following reasons :

It is noted that Applicants' have narrowed the scope of all claims under consideration by narrowing independent claims1 and 5 by changing " diamond or a diamond-containing material " to " diamond-containing material" .

Applicants' arguments regarding the teachings of Clevenger and Anschel are moot in view of the newly applied Ohya reference.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. Rao whose telephone number is (703) 3065945. The examiner can normally be reached on 8.00 to 5.00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Fahmy Wael can be reached on (703)308-4918. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Steven H. Rao
Patent Examiner
May 11, 2005.

LONG PHAM
PRIMARY EXAMINER